



Preparing for GOES-R: Pre-launch Data Operations Exercises (DOE)

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Introduction

- One of the primary objectives of the GOES-R Ground Segment is to “rehearse like we fly”. This is done through Data Operations Exercises (DOEs) and Ground Readiness Exercises (GREs) executed by the Data Operations Support Team (DOST), a team comprised of systems engineers from the Ground Segment Project (GSP) and Harris contractors as part of the Ground Readiness Team (GRT). These exercises assure that the Product Generation (PG) and Product Distribution (PD) systems, their interfaces, and operations teams are ready to support the mission. The systems under exercise are located at three locations, the NOAA Satellite Operations Facility (NSOF), Consolidated Backup (CBU), and the Wallops Command and Data Acquisition Station (WCADAS).
- The GREs and DOEs exercise these PG/PD systems in a nominal operations manner as well as under anomalous conditions. The PG/PD systems will be exercised for robustness, using a sequence of long duration data flows which will also support product consumer requests, such as requests from the National Weather Service (NWS) to support their test and integration activities.
- The GOES-R Ground Segment Product Readiness and Operations (PRO) Team is responsible for interfacing between the DOST and stakeholders such as Space Weather, the Calibration Working Group (CWG), the Algorithm Working Group (AWG), and Geostationary Lightning Mapper (GLM) scientists to ensure data is provided for analysis.

Goals and Objectives

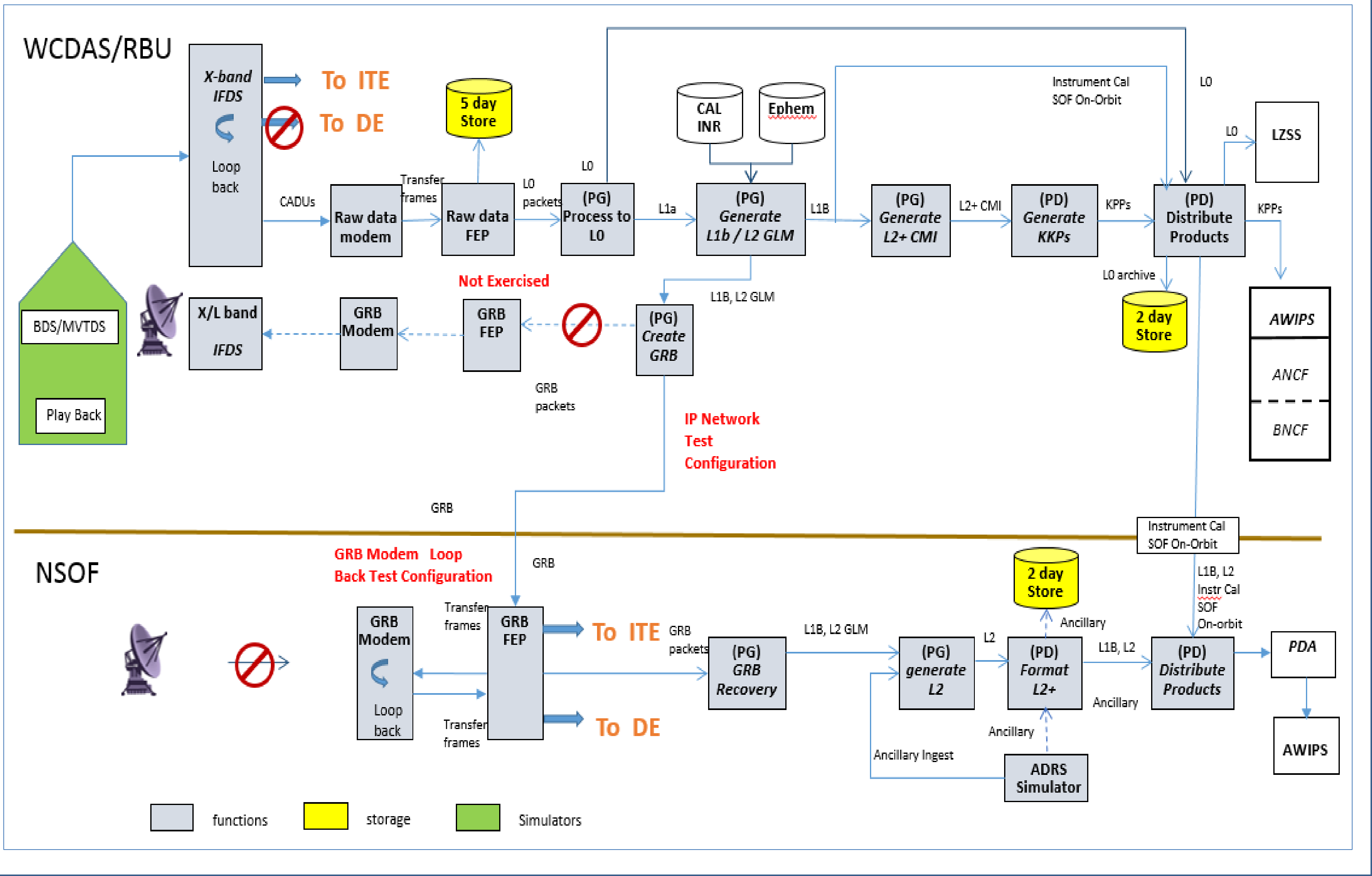
- Execute the GREs/DOEs per the Activity Planning Sheets (APS) and Detailed Activity Procedures.
- Coordinate all stakeholder and participant activities.
- Monitor and exercise PG/PD functionality using DOST authored Standard Operating Procedures (SOPs), and evaluate PG/PD systems for robustness.

PRO Coordination of GRE/DOE L1b & L2+ Product Analysis

- Coordinate distribution of exercise data to stakeholders for analysis.
- Stakeholders complete each post-analysis and compare findings to post-analysis results from prior exercise.
- Issues are sent to the Algorithm Action Review Team for a determination if they should become open Work Requests. See Poster 357: *Application of an Algorithm Change Process to the GOES-R Ground Segment* by R. Williams et al. for more information on this process.

Data Flow

Example Ground Segment configuration used during DOE-3, completed in September 2015.



Data Sets

MVTDS

- The Mission Validation Test Data Sets (MVTDS) are created by MIT Lincoln Labs and UW-CIMSS (ABI only). A two hour loop of only simulated data for each instrument is run continuously during an exercise.

Data set	Key source	Science basis
MVTDS – Thermal Vacuum (TVAC)	Recorded spacecraft data with instruments in TVAC including ABI hot tunnel test	Dull science scene for ABI Other instrument on
MVTDS – Synthetic: ABI Advanced Baseline Imager	AWG / UW-AIPS data	Basis in Weather Research and Forecasting Model (WRF) and AWG/UW forward modelling to L1b, with ABI vendor simulating LO
MVTDS – Synthetic: GLM	Flight simulation for lightning event and MIT-LL developed data for background	Lightning Data basis in Tropical Rainfall Measuring Mission Lightning Imaging Sensor (TRMM LIS). Background data developed from GOES data with instrument effects included
MVTDS – Synthetic: SUVI	MIT-LL developed data set	Basis in Solar Dynamic Observatory/Atmospheric Imaging Assembly (SDO AIA)
MVTDS – Synthetic: EXIS	MIT-LL developed data set	Basis in quiet supplied solar spectrum including GOES
MVTDS – Synthetic: SEISS	MIT-LL developed data set	Basis in Magnetospheric Plasma Data from the Los Alamos Magnetospheric Plasma Analyzer (LANL/MPA), GOES-15 data and Advanced Composition Explorer/ Solar Isotope Spectrometer (ACE/SIS) data.
MVTDS – Synthetic: MAG	MAGN-06 for quiet case and MIT-LL developed data set for storming case	Basis in GOES 15 Magnetometer quiet & storming case

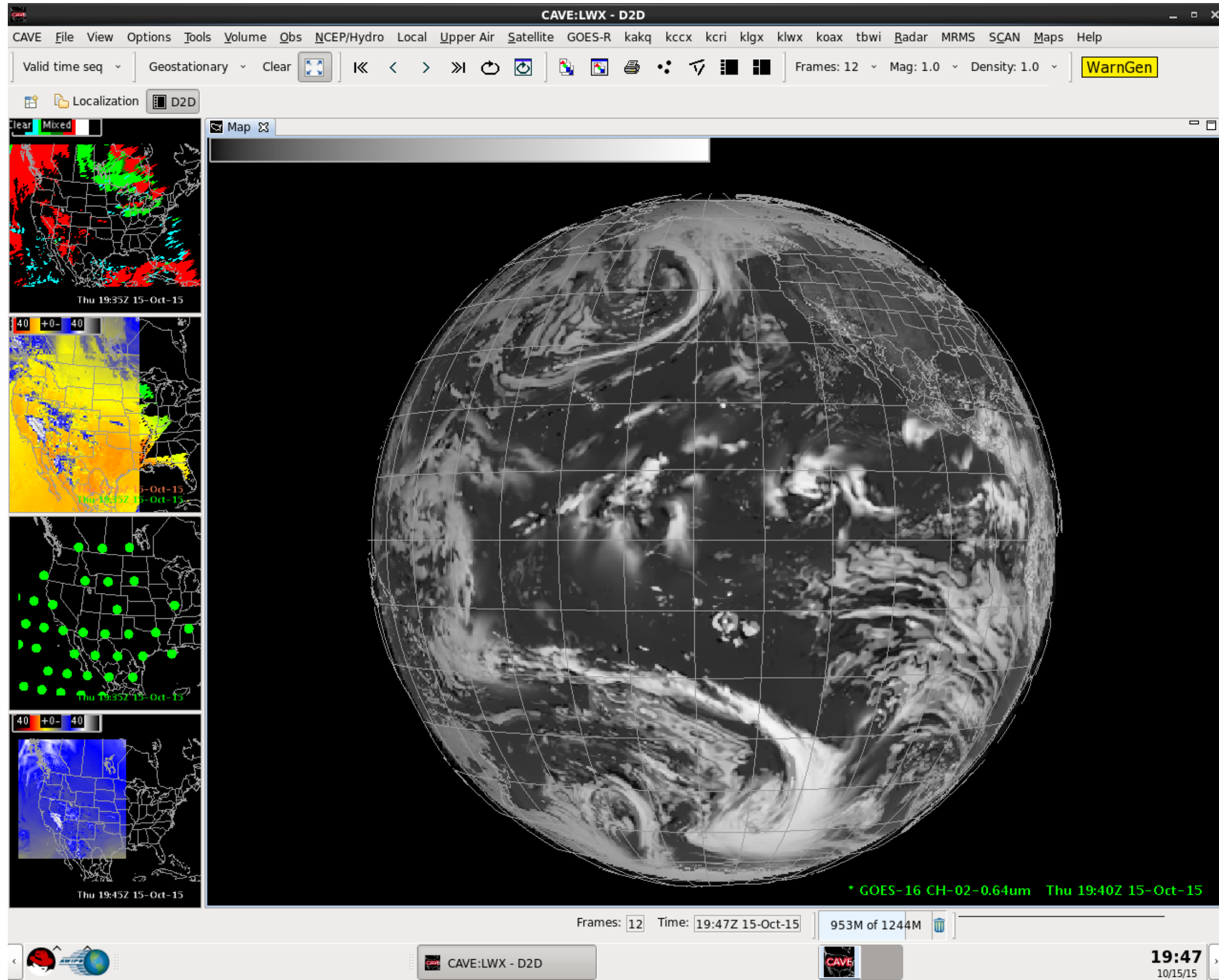
RaFTR and AAWDS

- The NOAA Cooperative Institute CIMSS creates 16 bands of real-time modeled data using the WRF-CHEM and GFS weather models .
- The Resample and Format: Timed Release (RaFTR) software formats the model data and interpolates to the GOES-R real-time cadence for sampling Earth. The resulting data set is called ABI AWG/UW-Madison Data Set (AAWDS). Then the AAWDS data are injected to the GOES-R Ground Segment data fabric.
- Finally, Product Distribution sends the NetCDF files to the NWS who broadcast the files over the Satellite Broadcast Network to AWIPS-II terminals at participating WFOs and NCEP National Centers.
- Forecasters then look at these simulated “GOES-R products” and can see the spatial/spectral/temporal benefits and make side-by-side comparisons against other tools.
- See Poster 740: *The Total Operational Weather Readiness - Satellites (TOWR-S) Project* by E. Guillot et al. for more NWS specific information.

GSSIM

- The GOES-R Ground System Data Simulator (Raw GSSIM) generates a simulated GOES-R downlink data stream to exercise and test data ingest, processing and distribution capabilities.
- GSSIM is considered a best practice by NASA Goddard mission development standards and enables effective preparation for integration test and data operations exercises.
- The GSSIM process consists of:
 - Providing Intermediate Frequency (IF), Transmission Control Protocol/Internet Protocol (TCP/IP) interfaces to the Raw Data Hard Drive Recorder (HDR)
 - Generating Channel Access Data Units (CADUs) for “canned science data” (BDS, MVTDS, and Error Dataset [EDS])
 - Generating CADUs for pattern data
 - Generating non-nominal data conditions
- During the exercise, the Raw GSSIM is used to play MVTDS data through the Ground System.

Sample Output



Simulated 0.64μm imagery from GRE DO 1 generated with AAWDS-RaFTR at the NWS Headquarters viewed in AWIPS-II. This is an example of what a forecaster at a Weather Forecast Office would see during operations.

Upcoming Exercises

The following table describes the upcoming GRE and DOE exercises as of December 2015. These dates are subject to change.

	GRE DO 2.1	GRE DO 2.2	GRE DO 2.3	GRE DO 3.1	DOE-4
Dates/Duration	January 11 – 15 (5 Days)	January 25–February 5 (12 Days)	February 8 – 17 (10 Days)	April 17- May 6 (20 Days)	July 18 – August 26 (40 Days)
Goals of Exercise	Inject errors into ground system and monitor for system response, EDS, short exercise, do priority ‘errors’	DO/NWS integration activity all sensors GLM w/ABI, Non-ABI (Primary), Auto observation pull, NWS error injection	Support for Product Distribution and Access (PDA) Environmental Satellite Product Distribution Service (ESPDs) Verification Event (DST 2), no planned errors for 8 day flow	This GRE runs concurrent with MOT for the MVT. Requirement is for at least a seven day overlap. Address the VCRM objectives. Repeat 14-day continuous flow.	Final major full system exercise pre-launch with NWS. This exercise now coincides with PDA ESPDS Validation Event 30 day flow.
Test datasets/duration	Error Data Set (EDS) 8-5 daily.	AAWDS and MVTDS Non-ABI (24/7 hrs)	AAWDS and MVTDS Non-ABI synthetic for minimum 8 days uninterrupted flow, 24/7	MVTDS synthetic for 14 days (P) RDR-TVAC for 2 hours (S)	AAWDS for 28 days (ABI/Non-ABI combined) (P) NWS: x days West, x days PLT x days East
PDA to externals	No	PDA to AWIPS ANCF/BNCF, NCEI-CO	PDA to AWIPS ANCF/BNCF, NCEI-CO, CLASS PDA to selected WFOs (CLASS forwards to MSFC)	PDA to AWIPS ANCF/BNCF, NGDC, CLASS PDA to selected WFOs (CLASS forwards to MSFC)	PDA to NWS/NCEI-CO/CLASS PDA to selected WFOs (STAR)

DOE-4 will be the most comprehensive exercise and will involve all major stakeholders. It will feature a long, continuous 28 day dataset run. The satellite will be tested in all positions (East, West, and Center). The exercise will also include the full use of the Notification messaging that follows the Environmental Satellite Processing Center procedure that will be used in operations.

SUMMARY

Data exercises allow the testing of ground system end-to-end functions while also allowing key stakeholders access to high quality, simulated data to ensure Ground System is prepared for immediate operation once GOES-R launches.

RELATED TALKS/POSTERS

- Matt Seybold, Preparing for GOES-R: Supporting User Readiness of Level 1b Data
- Wayne MacKenzie, Preparing for GOES-R: Supporting User Readiness of L2+ Products
- Ryan Williams, Application of a Consistent Algorithm Change Approach to the NESDIS Ground Systems
- Elizabeth McMichael, Poster 734, Preparing for GOES-R: Post-Launch Product Tests and Activities
- David Pogorzala, Poster 768, GRATDAT: A novel approach to monitoring and processing radiometric data from GOES-R ABI

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